

CLAIMS

What is claimed is:

1. A method comprising:

determining a concentration of a suppressor for a high-acid electroplating solution such that the suppressor concentration is sufficient to substantially reduce a plurality of electroplating defects; and

determining a concentration of a chloride for the high-acid electroplating solution such that the chloride concentration is sufficient to catalyze the suppressor.

2. The method of claim 1 wherein the plurality of electroplating defects include protrusion defects, bare test wafer defects, and pit defects.

3. The method of claim 2 wherein the concentration of suppressor is in the range of 3.3 ml/l – 20 ml/l.

4. The method of claim 3 wherein the concentration of suppressor is approximately 20 ml/l.

5. The method of claim 1 wherein the chloride level is in the range of 30 mg/l – 65 mg/l.

6. The method of claim 1 further comprising:

determining a concentration of a leveler for the high-acid electroplating solution, the concentration of leveler determined to reduce within die thickness variation to a specified value.

7. The method of claim 6 wherein the leveler concentration is in the range of 8ml/l – 12ml/l.

8. The method of claim 6 further comprising:

determining a concentration of an accelerator for the high-acid electroplating solution based upon the chloride concentration and the leveler concentration.

9. The method of claim 8 wherein the accelerator concentration is in the range of 1.5 ml/l – 3.3ml/l for a chloride concentration greater than 30 mg/l or a leveler concentration greater than 4 ml/l.

10. The method of claim 1 wherein the chloride concentration is determined based upon one or more characteristics of a substrate.

11. The method of claim 10 wherein the one or more characteristics of the substrate include feature size and feature aspect ratio.

12. A high-acid electroplating solution comprising:
an acid;

a conductive metal;
a suppressor, a concentration of the suppressor sufficient to substantially reduce a plurality of electroplating defects; and
a chloride, a concentration of the chloride sufficient to catalyze the suppressor.

13. The high-acid electroplating solution of claim 12 wherein the plurality of electroplating defects include protrusion defects, bare test wafer defects, and pit defects.

14. The high-acid electroplating solution of claim 13 wherein the concentration of suppressor is in the range of 3.3 ml/l – 20 ml/l.

15. The high-acid electroplating solution of claim 14 wherein the concentration of suppressor is approximately 20 ml/l.

16. The high-acid electroplating solution of claim 12 wherein the chloride level is in the range of 30 mg/l – 65 mg/l.

17. The high-acid electroplating solution of claim 12 further comprising:
a leveler, a concentration of the leveler sufficient to reduce within die thickness variation to a specified value.

18. The high-acid electroplating solution of claim 17 wherein the leveler concentration is in the range of 4ml/l – 12ml/l.
19. The high-acid electroplating solution of claim 17 further comprising:
an accelerator, a concentration of the accelerator based upon the chloride concentration and the leveler concentration.
20. The high-acid electroplating solution of claim 19 the accelerator concentration is in the range of 1.5 ml/l – 3.3ml/l for a chloride concentration greater than 30 mg/l or a leveler concentration greater than 8 ml/l.
21. The high-acid electroplating solution of claim 12 wherein the chloride concentration is determined based upon one or more characteristics of a substrate.
22. The high-acid electroplating solution of claim 21 wherein the one or more characteristics of the substrate include feature size and feature aspect ratio.
23. An apparatus comprising:
a substrate having one or more features formed thereon; and
a layer of conductive metal formed on the substrate by electroplating the substrate using a high-acid electroplating solution, the high-acid electroplating solution including a suppressor concentration sufficient to substantially reduce a plurality of electroplating defects and a chloride concentration sufficient to catalyze the suppressor.

24. The apparatus of claim 23 wherein the substrate is silicon and the conductive metal is a metal selected from the group consisting essentially of copper, silver, gold and alloys thereof.

25. The apparatus of claim 23 wherein at least one of the plurality of features has a sub-micron dimension and a high aspect ratio.

26. The apparatus of claim 23 wherein the plurality of electroplating defects include protrusion defects, bare test wafer defects, and pit defects.

27. The apparatus of claim 23 wherein the suppressor concentration is in the range of 3.3 ml/l – 20 ml/l.

28. The apparatus of claim 27 wherein the concentration of suppressor is approximately 20 ml/l.

29. The apparatus of claim 27 wherein the chloride level is in the range of 30 mg/l – 65 mg/l.

30. The apparatus of claim 23 wherein the chloride concentration is determined based upon a size and an aspect ratio of one or more of the features.